

Application Serial No. 10/829,451
Reply to Office Action dated August 13, 2004
Page 2 of 7

Amendments to the Claims:

This listing of claims will replace all prior versions, and listing, of claims in the application:

Listing of Claims:

1- 21. (canceled)

22. (currently amended) A mass spectrometer comprising:
an ion tunnel ion trap comprising ≥ 10 ring or plate electrodes having substantially similar internal apertures between 2-10 mm in diameter and wherein a DC potential gradient is maintained, in use, along a portion of the ion tunnel ion trap and two or more axial potential wells are formed along the length of the ion tunnel ion trap; and
means for introducing a gas into said ion tunnel ion trap for collisional cooling without fragmentation of ions.

23. (currently amended) A mass spectrometer comprising:
an ion tunnel ion trap comprising at least three segments, each segment comprising at least four electrodes having substantially similar sized apertures through which ions are transmitted in use; and
means for introducing a gas into said ion tunnel ion trap for collisional cooling without fragmentation of ions;
wherein in a mode of operation:
electrodes in a first segment are maintained at substantially the same first DC potential but adjacent electrodes are supplied with different phases of an AC or RF voltage supply;
electrodes in a second segment are maintained at substantially the same second DC potential but adjacent electrodes are supplied with different phases of an AC or RF voltage supply;
electrodes in a third segment are maintained at substantially the same third DC potential but adjacent electrodes are supplied with different phases of an AC or RF voltage supply;
wherein said first, second and third DC potentials are all different.

Application Serial No. 10/829,451
Reply to Office Action dated August 13, 2004
Page 3 of 7

24. (canceled)

25. (currently amended) A mass spectrometer comprising:
an ion tunnel ion trap, said ion tunnel ion trap comprising a plurality of electrodes having apertures through which ions are transmitted in use, and wherein in a mode of operation trapping DC voltages are supplied to some of said electrodes so that ions are confined in two or more axial DC potential wells; and
means for introducing a gas into said ion tunnel ion trap for collisional cooling without fragmentation of ions.

26. (currently amended) A mass spectrometer comprising:
an ion tunnel ion trap comprising a plurality of electrodes having apertures through which ions are transmitted in use, and wherein in a mode of operation a V-shaped, W-shaped, U-shaped, sinusoidal, curved, stepped or linear axial DC potential profile is maintained along at least a portion of said ion tunnel ion trap; and
means for introducing a gas into said ion tunnel ion trap for collisional cooling without fragmentation of ions.

27. (currently amended) A mass spectrometer comprising:
an ion tunnel ion trap comprising a plurality of electrodes having apertures through which ions are transmitted in use, and wherein in a mode of operation an upstream portion of the ion tunnel ion trap continues to receive ions into the ion tunnel ion trap whilst a downstream portion of the ion tunnel ion trap separated from the upstream portion by a potential barrier stores and periodically releases ions; and
means for introducing a gas into said ion tunnel ion trap for collisional cooling without fragmentation of ions.

28. (original) A mass spectrometer as claimed in claim 27, wherein said upstream portion of the ion tunnel ion trap has a length which is at least 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, or 90% of the total length of the ion tunnel ion trap.

29. (original) A mass spectrometer as claimed in claim 27, wherein said downstream portion of the ion tunnel ion trap has a length which is less than or equal to 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, or 90% of the total length of the ion tunnel ion trap.

Application Serial No. 10/829,451
Reply to Office Action dated August 13, 2004
Page 4 of 7

30. (original) A mass spectrometer as claimed in claim 27, wherein the downstream portion of the ion tunnel ion trap is shorter than the upstream portion of the ion tunnel ion trap.

31. (original) A mass spectrometer as claimed in claim 27, wherein ions are substantially not fragmented within said ion tunnel ion trap.

32-37. (canceled)

38. (previously presented) A mass spectrometer as claimed in claim 22, wherein said ion tunnel ion trap accumulates and periodically releases ions without substantially fragmenting the ions.

39. (previously presented) A mass spectrometer as claimed in claim 22, wherein said ion tunnel ion trap comprises a plurality of segments, each segment comprising a plurality of the electrodes having the internal apertures through which ions are transmitted and wherein all the electrodes in a segment are maintained at substantially the same DC potential and wherein adjacent electrodes in a segment are supplied with different phases of an AC or RF voltage.

40. (canceled)

41. (previously presented) A mass spectrometer as claimed in claim 25, wherein said ion tunnel ion trap accumulates and periodically releases ions without substantially fragmenting the ions.

42. (previously presented) A mass spectrometer as claimed in claim 25, wherein said ion tunnel ion trap comprises a plurality of segments, each segment comprising a plurality of the electrodes having the apertures through which the ions are transmitted and wherein all the electrodes in a segment are maintained at substantially the same DC potential and wherein adjacent electrodes in a segment are supplied with different phases of an AC or RF voltage.

43. (canceled)

Application Serial No. 10/829,451
Reply to Office Action dated August 13, 2004
Page 5 of 7

44. (previously presented) A mass spectrometer as claimed in claim 26, wherein said ion tunnel ion trap accumulates and periodically releases ions without substantially fragmenting the ions.

45. (previously presented) A mass spectrometer as claimed in claim 26, wherein said ion tunnel ion trap comprises a plurality of segments, each segment comprising a plurality of the electrodes having the apertures through which the ions are transmitted and wherein all the electrodes in a segment are maintained at substantially the same DC potential and wherein adjacent electrodes in a segment are supplied with different phases of an AC or RF voltage.

46. (canceled)